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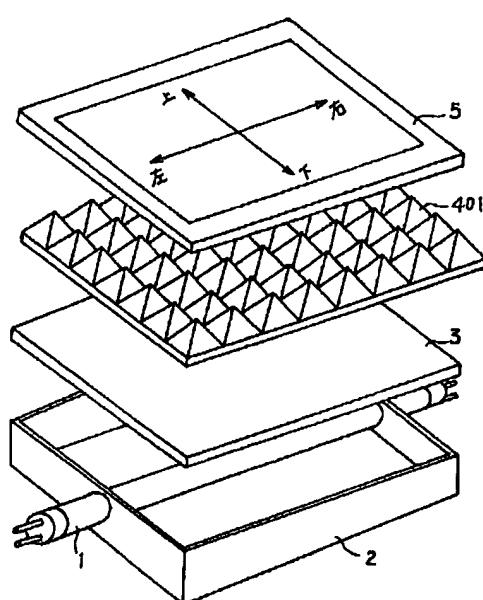
(54)【発明の名称】 表示装置

(57)【要約】

【目的】2次元方向の光を集光し、光源からの光を効率良く利用した高輝度な表示装置を提供すること。

【構成】本発明は、透過型表示パネルと、該表示パネルを照明するための光源と、片面に複数のプリズムを形成した平板状のプリズムシートを前記表示パネルの光源側に配置した表示装置において、前記複数のプリズムの形状を1つ以上の斜面を持つ錐体状にした表示装置。

図 1



PATENT ABSTRACTS OF JAPAN

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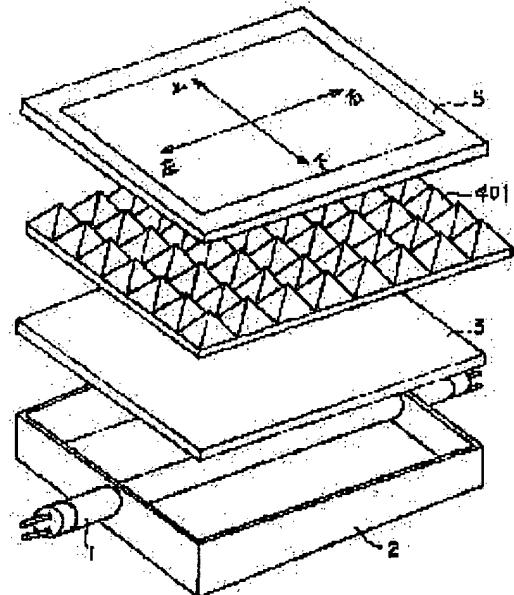
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(54) DISPLAY DEVICE

(57)Abstract:

PURPOSE: To obtain the display device whose brightness is high and which can efficiently utilize light from a light source by making the shapes of plural prisms a pyramid state having one or more slant faces.

CONSTITUTION: A conventional back light system constituted of the light source 1 such as a fluorescent tube, etc., a reflection box 2 whose inside surface is a mirror surface or a white surface, etc., and an opal diffusing board 3; and a plate-like prism sheet 401 in which plural quadrangular pyramid prisms are arrayed in a grid-state on one surface on the light source 1 side of a transmission type display panel 5 are arranged, and the flat surface side of the prism sheet 401 is on the diffusing board 3 side. In this case, as to the partially enlarged flat surface and the cross section of the prism sheet 401, the shape of the prism is the quadrangular pyramid state, and the cross section in a right-and-left direction and the cross section in an up-and-down direction are tooth-shaped. The diffused light made incident on the flat surface side of the prism sheet 401 is condensed in a normal direction by the prism sheet. Furthermore, a collecting rate is adjusted by the angle of the prism.



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CLAIMS

[Claim(s)]

[Claim 1]In a display which has arranged a transmission type display panel, a light source for illuminating this display panel, and a plate-like prism sheet that formed two or more prism at least in one side to the light source side of this display panel, A display having made shape of prism of this plurality into the shape of a cone with one or more slant faces, and arranging to a lattice eye.

[Claim 2]A display making the bottom of prism of the shape of this cone into a major axis and a form with the direction of a minor axis in claim 1.

[Claim 3]A display having used shape of prism of this plurality as a triangular prism, and arranging to a lattice eye in claim 1.

[Claim 4]A display having made shape of prism of this plurality into sphere form, and arranging to a lattice eye in claim 1.

[Claim 5]A display having arranged a lens sheet which formed in one side [at least] two or more transmission type display panels, light sources for illuminating this display panel, and microlenses of shape which omitted a both-ends side of a semicircular pillar aslant in the shape of a lattice to the light source side of this display panel.

[Claim 6]A display, wherein each height [or] of prism of this plurality, array pitches, or shape of prism differs in any 1 paragraph of claims 1-5.

[Claim 7]In a display which has arranged a transmission type display panel, a light source for illuminating this display panel, and a plate-like prism sheet that installed prism of trianglepole shape prolonged in the one direction in one side side by side to the light source side of this display panel, making this prism sheet into two sheets -- mounting directions of prism of each trianglepole shape -- a display having arranged so that it may become a form which intersects perpendicularly mutually.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]**[0001]**

[Industrial Application] This invention relates to the display which comprises a transmission type display panel and light sources, such as a liquid crystal, and relates to the high-intensity display whose utilization efficiency of the light from a light source improved.

[0002]

[Description of the Prior Art] As rise-in-luminosity art of the conventional display, JP,4-67016,A has art of a statement, and it is shown in drawing 16. Drawing 16 is what showed the exploded perspective view of conventional technology, and shows the light source 1 by a fluorescent tube etc., the reflective box 2 which made the inner surface a mirror plane, a white face, etc., the milky diffusion board 3, the plate-like prism sheet 4 which installed the prism of two or more trianglepole shape in the sliding direction side by side at one side, and the transmission type display panel 5. In drawing 16, it reflects by the inner surface of the direct or reflective box 2, and the light from the light source 1 enters into the diffusion board 3, and turns into uniform **** with this diffusion board 3. And the light component which it is going to diffuse in a sliding direction with the prism sheet 4 can be condensed by the normal line direction to the 5th page of a display panel, it can enter into the display panel 5, and a high-intensity display image can be obtained.

[0003]

[Problem(s) to be Solved by the Invention] Since the shape of the prism on the prism sheet 4 is a triangular prism, a condensing operation is only the direction of one dimension, and the above-mentioned conventional technology was not taken into consideration about the direction of two dimensions.

[0004] This invention solves the above-mentioned problem and an object of this invention is to provide a still higher-intensity display.

[0005]

[Means for Solving the Problem] In a display which has arranged a transmission type display panel, a light source for illuminating this display panel, and a plate-like prism sheet that formed two or more prism in one side to the light source side of this display panel, this invention is the display which made shape of prism of this plurality the shape of a cone with one or more slant faces.

[0006]

[Function] By arranging the plate-like prism sheet which formed two or more prism in one side at the light source side of a transmission type display panel, and making shape of the prism of this plurality into the shape of a cone with one or more slant faces, The diffused light from the light source which enters into this display panel can be condensed about the direction of two dimensions, and a high-intensity display can be provided.

[0007]

[Example] The back light system from the former which drawing 1 shows the exploded perspective view of the 1st example of this invention, and comprises the light source 1 by a fluorescent tube etc., the reflective box 2 which made the inner surface a mirror plane, a white face, etc., and the milky diffusion board 3, The plate-like prism sheet 401 which arranged the prism of the shape of two or more pyramid to the lattice eye at one side is arranged, and the flat-surface side of this prism sheet 401 is turned on the light source 1 side of the transmission type display panel 5 at the diffusion board 3 side.

[0008] Drawing 2 shows the partial enlarged plan view and sectional view of the prism sheet 401 in drawing 1, and the shape of prism is a pyramid-like.

AA'sectional view of a longitudinal direction and BB'sectional view of a sliding direction are serrate.

[0009] In [drawing 3 is a figure showing the locus of the light in AA'section of the longitudinal direction in drawing 2, and] the prism sheet 401 of prism-angles theta₅, Optical I₁, which enters out of the air (refractive-index n₀=1) by angle theta₁ to the normal line direction of the flat surface 401a is refracted in angle theta₂ in the interface of air and the flat surface 401a, and penetrates the inside of the prism sheet 401. Furthermore, optical I₁ enters into the prism plane 401b by angle theta₃ to the normal line direction of this prism plane 401b, is refracted in angle theta₄ to the normal line direction of the flat surface 401a, and becomes optical I₂ emitted into the air.

[0010] The above-mentioned angle theta₁ - theta₄ are the following expressions of relations.

[0011]

[Equation 1]

$$\theta_2 = \sin^{-1} (\sin \theta_1 / n_1) \quad (n_1 : \text{プリズムシートの屈折率})$$

$$\theta_3 = \theta_5 - \theta_2$$

$$\theta_4 = \theta_5 - \sin^{-1} (n_1 \cdot \sin \theta_3)$$

$$= \theta_5 - \sin^{-1} [n_1 \cdot \sin \{ \theta_5 - \sin^{-1} (\sin \theta_1 / n_1) \}] \quad \dots \text{(数1)}$$

[0012] For example, the construction material of this prism sheet 401 with an acrylic resin (n₁=1.49). Supposing optical I₁ enters into the flat surface 401a at angle theta₁=40 degree at the time of prism-angles theta₅=35 degree, optical I₂ emitted from the prism plane 401b will be emitted at angle theta₄=21 degree from (several 1).

[0013] Thus, the diffused light which enters into the flat-surface side of a prism sheet is condensed by the normal line direction with this prism sheet. The condensing rate is adjusted with prism angles.

[0014] In [a luminous-intensity distribution map when drawing 4 (a) looks at the display of this example from a sliding direction, and (b) show the case from a longitudinal direction, and] a sliding direction and a longitudinal direction, The luminous-intensity distribution 501a and 501b on the diffusion board 3, The shape of prism serves as the form where the direction light of four directions was condensed by the normal line direction to the display panel 5 with the pyramid-like prism sheet 401 like the luminous-intensity distribution 502a and 502b on the prism sheet 401, and the luminous-intensity distribution on the display panel 5 also becomes like 503a and 503b.

[0015] That is, the display of this example is a high-intensity display which condensed about the direction of two dimensions of the direction of four directions, and used the light from a light source efficiently.

[0016] Drawing 5 shows the 2nd partial enlarged plan view and sectional view of the prism sheet 402 of an example, and shows II' and JJ'sectional view. Since the light which enters into the prism sheet 402 is the diffused light which goes not only in the direction of four directions but in all the directions, The section from more than a 2-way should just have serrate prism shape not only like the direction of four directions but like II' and JJ'section, and even when shape of prism is made into six-sided pyramids so that it may be shown figure 5, the effect of the same this invention as the 1st example can be acquired.

[0017] Drawing 6 shows the 3rd partial enlarged plan view and sectional view of the prism sheet 403 of an example, and shows KK' and LL'sectional view. As shown in drawing 6, even when shape of prism is made into a triangular pyramid, the effect of the same this invention as the 1st and 2 example can be acquired.

[0018] Drawing 7 shows the 4th prism-shaped partial enlarged plan view and sectional view of the prism sheet 404 of an example, and shows MM' and NN'sectional view. As shown in drawing 7, the shape of prism is a form where the slant face combined the pyramid and cone of one curved surface with the square in the bottom. Since MM' of a 2-way and NN'section have serrate prism shape, the effect of the same this invention as the 1-3rd examples can be acquired.

[0019] Drawing 8 shows the 5th partial enlarged plan view and sectional view of the prism sheet 405 of an example, and shows OO' and PP'sectional view. Prism shape is the shape not of a cone but sphere form, and has become a form, the shape of i.e., a lens array, where it was arranged by the lattice eye so that drawing 8 may show. Thereby, it is condensed and the diffused light which enters with each lens can acquire the effect of the same this invention as the 1-4th examples.

[0020] Drawing 9 shows the 6th partial enlarged plan view and sectional view of the prism sheet 406 of an

example, and shows the prism sheet 406 and UU'sectional view in consideration of the luminance distribution on the diffusion board 3. In drawing 9, although the luminosity on the about one-light source diffusion board 3 is high, luminosity becomes low, so that it becomes far from the light source 1. Then, prism-angles θ_9 of the prism sheet 406 is made so large that it becomes far from the light source 1, and the refractive index of prism is enlarged. By that cause, the degree of condensing of the diffused light of prism can be raised, so that it becomes a periphery of the display screen on a liquid crystal panel, the luminance distribution on the diffusion board 3 can be reduced on the prism sheet 406, and uniform **** can be obtained with the rise in luminosity which is an effect of the same this invention as the 1-5th examples. In order to adjust prism-angles θ_9 of the prism sheet 406, even if it changes the height of each prism, an array pitch, and the shape of prism, the effect of this invention is not barred.

[0021] Drawing 10 shows the 7th partial enlarged plan view and sectional view of the prism sheet 407 of an example, and the shape of prism is a pyramid. In the bottom, a major axis direction shows prism-angles θ_9 of the prism sheet 407 of the rectangle of a sliding direction, XX' of the direction of four directions, WW'sectional view, and XX'section, and prism-angles θ_{10} of WW'section. For example, a display is attached to the back of seats, such as vehicles for passengers, and a display image may be seen from a backseat. In such a case, about the viewing angle range of a sliding direction, there are the degree of reclining angle of a front seat, a view ** person's height, etc., and a certain amount of viewing angle range is required. On the other hand, about a longitudinal direction, since the seat is being fixed, a viewing angle range is hardly required. The prism sheet 407 of drawing 10 changes the upper and lower sides, prism-angles θ_9 of a longitudinal direction, and θ_{10} in $\theta_9 < \theta_{10}$, makes a condensing operation of a sliding direction smaller than a longitudinal direction, and is giving a certain amount of viewing angle range to the sliding direction.

It is made to correspond when attached to the back of seats, such as the above-mentioned vehicles for passengers.

[0022] A luminous-intensity distribution map when drawing 11 (a) looks at the display of this example from a sliding direction, and (b) show the case from a longitudinal direction. In drawing 11 (a) and (b), on the diffusion board 3, the luminous-intensity distribution 601a and 601b of the direction of four directions, In the bottom, a major axis direction by a pyramid with the prism sheet 407 of the rectangle of a sliding direction. [the shape of prism] The forms of the luminous-intensity distribution 602a on the prism sheet 407 of a sliding direction and the luminous-intensity distribution 602b of a longitudinal direction differ, and from the upper and lower sides, the direction of a longitudinal direction serves as the form where light was condensed by the normal line direction to the display panel 5, and becomes like 603a and 603b also in the luminous-intensity distribution on the display panel 5.

[0023] That is, this example is the high-intensity display which could change the condensing operation of the direction of two dimensions, respectively, and used the light from a light source efficiently according to the usage of a display.

[0024] Drawing 12 shows the 8th partial enlarged plan view and sectional view of the prism sheet 408 of an example, and shows the upper and lower sides, ZZ' of a longitudinal direction, and YY'sectional view. As shown in drawing 12, as for the prism sheet 408, prism shape is trianglepole shape and it is arranged by the lattice eye. ZZ'section of a sliding direction is serrate and YY'section of a longitudinal direction is a trapezoid.

As for the entering diffused light, in a sliding direction, a condensing operation is adjusted by prism-angles θ_{11} from the light incidence face 10 of the prism sheet 408. In a longitudinal direction, a condensing operation can be adjusted with length P_1 of the prism of a triangular prism, and a condensing operation becomes large, so that P_1 is short. This example is also the high-intensity display which could change the condensing operation of the direction of two dimensions, respectively, and used the light from a light source efficiently like the 7th example according to the usage of a display.

[0025] Drawing 13 shows the 9th partial enlarged plan view and sectional view of the prism sheet 409 of an example, and shows the upper and lower sides, DD' of a longitudinal direction, and CC'sectional view. As for the prism sheet 409, as shown in drawing 13, the shape of prism is a pyramid, the bottom is [a major axis direction] a rectangle of a sliding direction, and it is arranged by the lattice eye.

DD'section of a sliding direction is serrate [continuous] and CC'section of a longitudinal direction is serrate

[which has a flat part of length P_2 between ***** prism / discontinuous].

As for the entering diffused light, in a sliding direction, a condensing operation is adjusted by prism-angles θ_{12} from the light incidence face 11 of the prism sheet 409. In a longitudinal direction, since it does not condense in the flat part of length P_2 , a condensing operation can be adjusted with length P_2 , and a condensing operation becomes large, so that P_2 is short. This example can also acquire the same effect as the 7th and 8 example.

[0026] Drawing 14 shows the 10th partial enlarged plan view and sectional view of the lens sheet 410 of an example, and shows the upper and lower sides, FF' of a longitudinal direction, and EE'sectional view. As shown in drawing 14, two or more lens sheets 410 are formed in one side [at least] in the shape of a lattice in the microlens of the shape which omitted the both-ends side of the semicircular pillar aslant.

FF'section of a sliding direction is a lens-like and EE'section of a longitudinal direction is a trapezoid.

As for the entering diffused light, in a sliding direction, a condensing operation is adjusted with the curvature of a lens from the light incidence face of the lens sheet 410. In a longitudinal direction, a condensing operation can be adjusted with length P_3 of a lens like the 8th example. This example can also acquire the same effect as the 7-9th examples.

[0027] Drawing 15 shows the exploded perspective view of the 11th example of this invention, it piles it up so that it may become a relation a relation and the mutual direction of prism cross at right angles using two sheets of the conventional prism sheets 4a and 4b which installed the prism of two or more trianglepole shape in the one direction side by side at one side, and it is arranged to the light source side of the display panel 5. In drawing 15, the light component of a longitudinal direction is condensed with the prism sheet 4a, the light component of a sliding direction is condensed with the prism sheet 4b, the light of the direction of two dimensions is condensed, and the diffused light from the diffusion board 3 enters into the liquid crystal panel 5. This example is the high-intensity display which used two prism sheets from the former, condensed the light of the direction of two dimensions, and used the light from a light source efficiently.

[0028]

[Effect of the Invention] As explained above, according to this invention, the high-intensity display which used the light from a light source efficiently is provided.

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DRAWINGS

[Drawing 1]

図 1

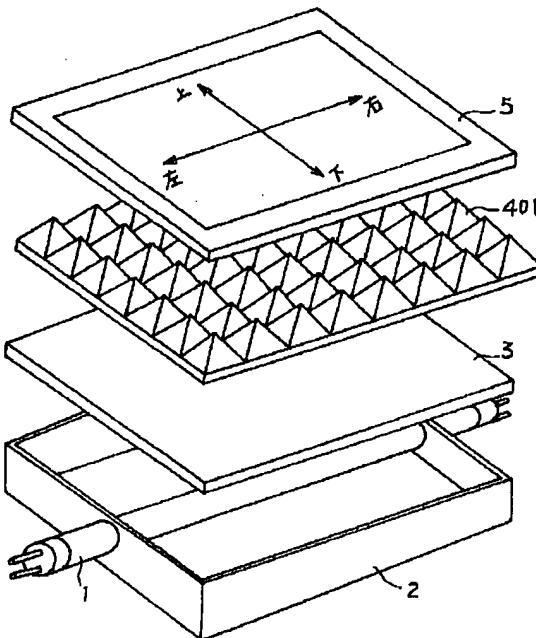
**[Drawing 2]**

図 2

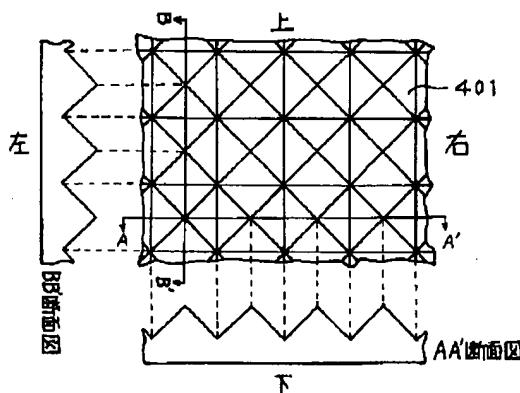
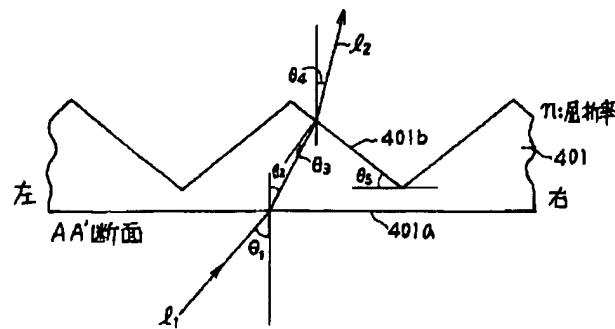
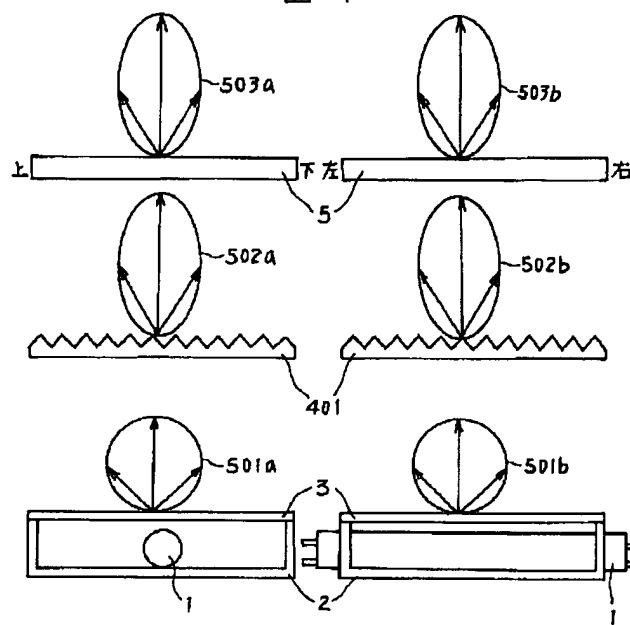
**[Drawing 3]**

図 3



[Drawing 4]

図 4

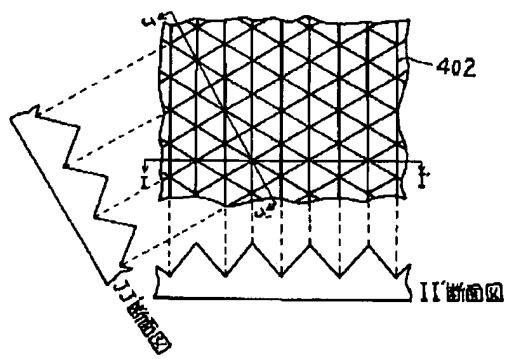


(a) 上下方向

(b) 左右方向

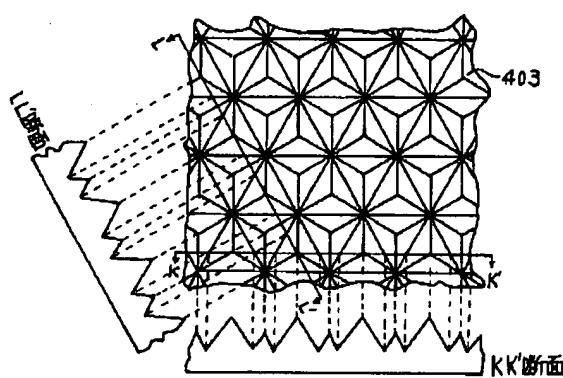
[Drawing 5]

図 5



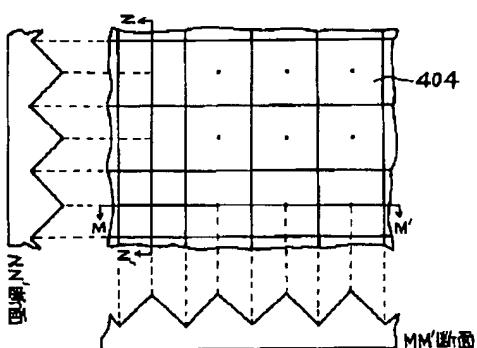
[Drawing 6]

図 6



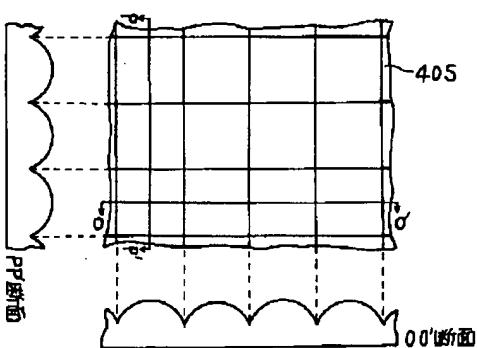
[Drawing 7]

図 7



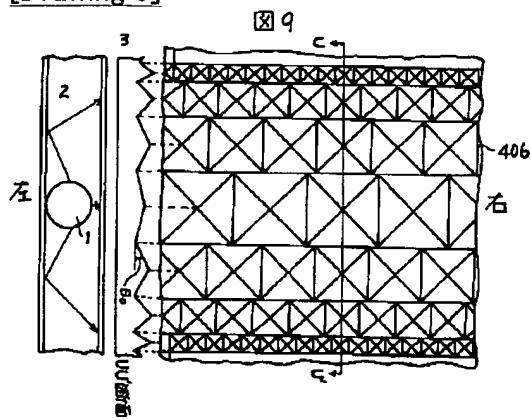
[Drawing 8]

図 8

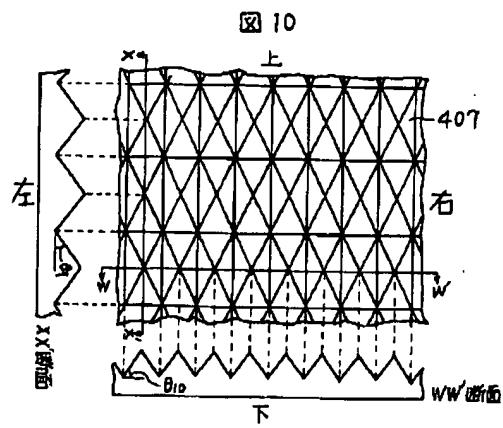


[Drawing 9]

図 9

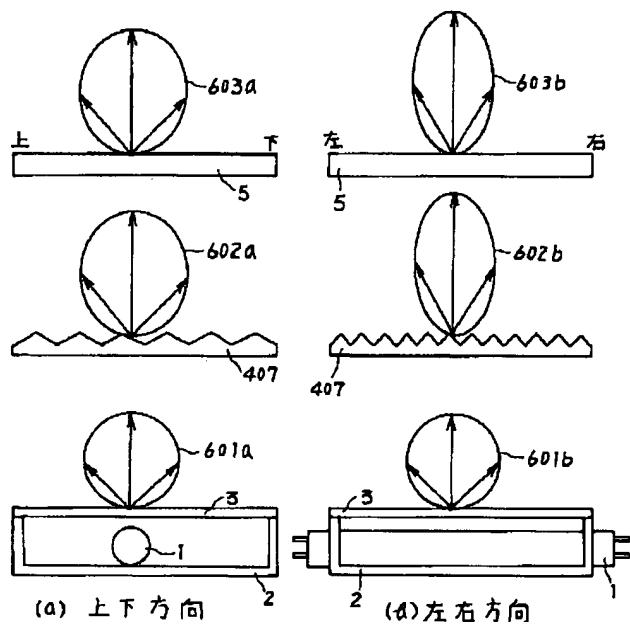


[Drawing 10]

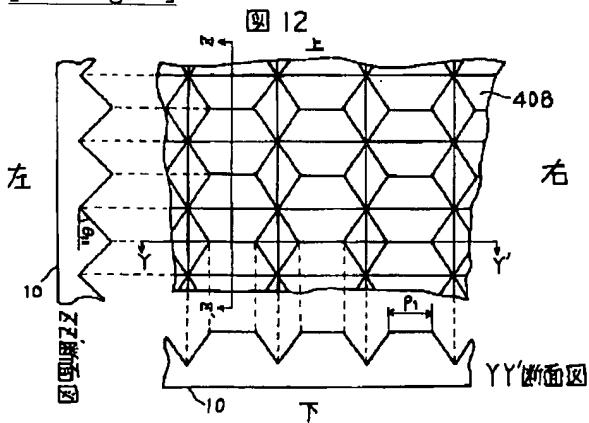


[Drawing 11]

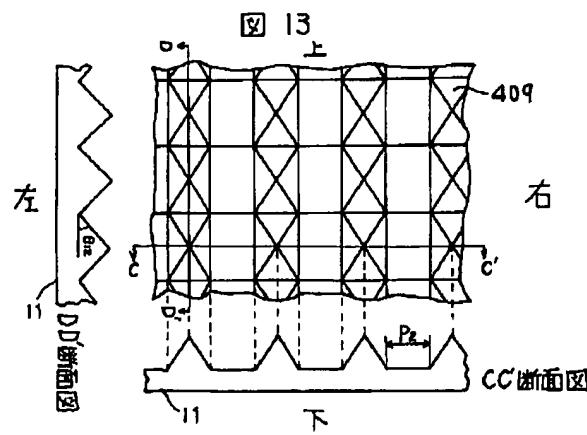
図 11



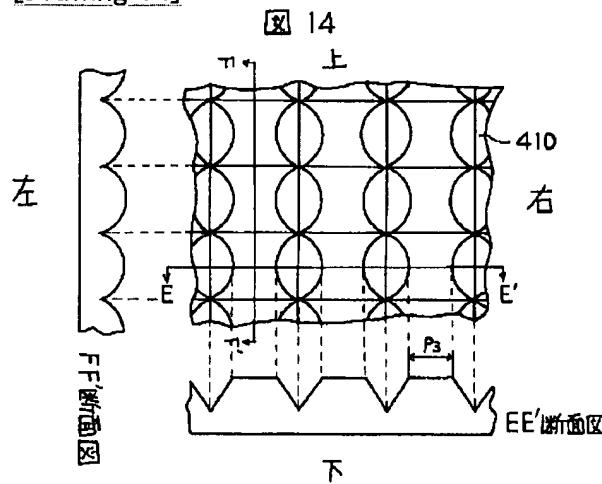
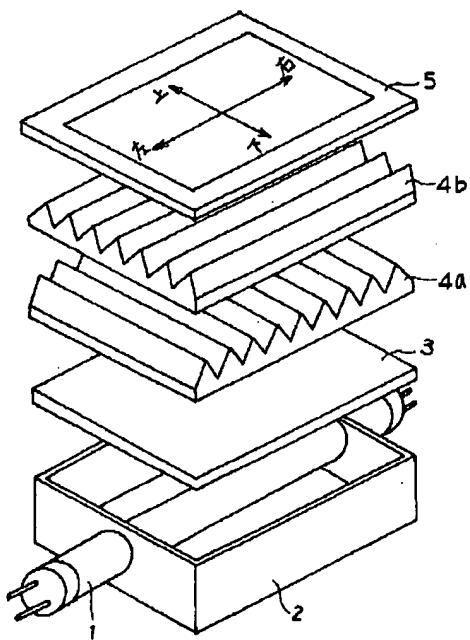
[Drawing 12]



[Drawing 13]

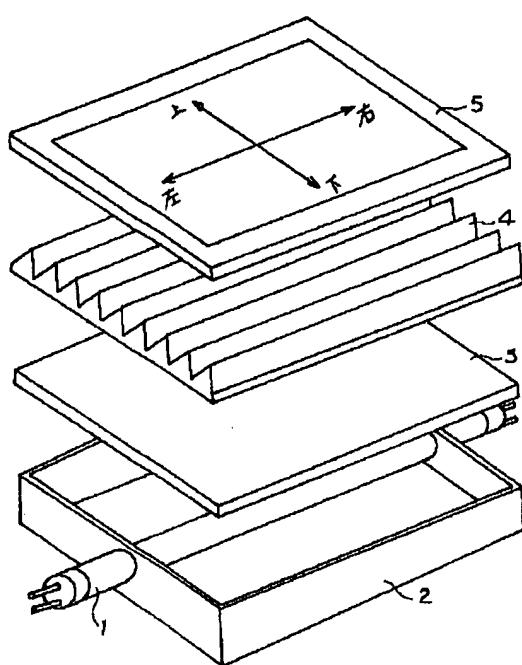


[Drawing 14]

[Drawing 15]
図 15

[Drawing 16]

図16



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